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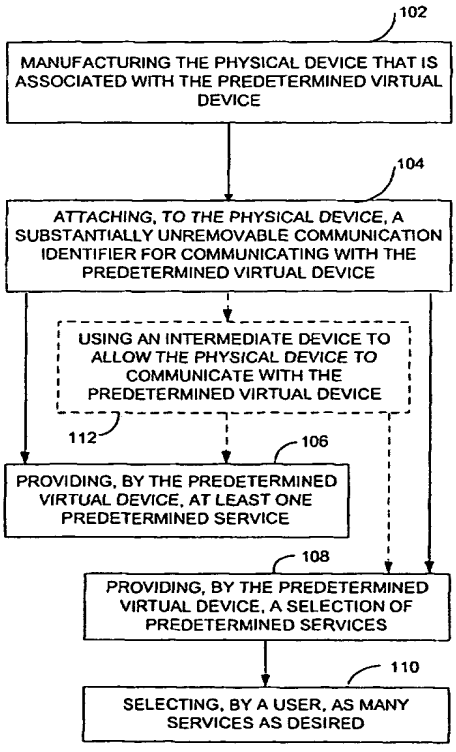
[Continued on next page]

(54) Title: COMMUNICATION IDENTIFIER FOR A PHYSICAL DEVICE'S AVATAR



(57) Abstract: The present invention provides a system (302, 304; 402, 406) and method (102, 104, 106, 108, 110; 202, 204, 206, 208, 210) for automatically linking a physical device and a predetermined associated virtual device to provide the physical device with access to at least one service. The method includes the steps of: manufacturing (102) the physical device that is associated with the predetermined virtual device and attaching (104), to the physical device, a substantially non-removable communication identifier for communicating with the predetermined virtual device. The communication identifier typically facilitates communication over an information space such as the Internet.

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COMMUNICATION IDENTIFIER FOR A PHYSICAL DEVICE'S AVATAR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present invention is related to patent applications docket numbers 10013446 and 10013447, by the same inventors, Charles M. Patton, Stephen A. Loughran, and Rajeev K. Pandey, being filed contemporaneously with the present application.

BACKGROUND OF THE INVENTION

[0002] In the past, devices have been manufactured to be free-standing, i.e., to be in final form when they come from the manufacturer. As software implementations became less expensive than hardware implementations, manufacturers found that it became cost-effective to manufacture many devices that could be updated by reloading the devices with updated software. Then, as more devices were utilizing updated software, it became convenient to download the software via telephone or the Internet.

[0003] As devices have continued to evolve, there has now become a need for a two-part device that consists of a physical device and a virtual device. The physical device needs to interact with a virtual device so that the virtual device can provide for transfer of ownership to the new owner and can provide additional services to the physical device. In order for such a system to be readily coordinated, there is a need for a virtual device associated with the physical device to be able to be linked to the physical device in a convenient, easy-to-use manner. Thus, there is a need for the physical device to have a permanent Internet address for communication

with the associated virtual device, wherein the address is easily ascertainable by the user.

SUMMARY OF THE INVENTION

[0004] The present invention encompasses a system and method that provides automatic linking of a physical device and a predetermined associated virtual device. The physical device that is associated with the predetermined virtual device is manufactured and a substantially unremovable communication identifier for communicating with the predetermined virtual device is attached to the physical device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Figure 1 is a flowchart showing one embodiment of steps in accordance with one embodiment of the method of the present invention.

[0006] Figure 2 is a flowchart showing another embodiment of steps in accordance with the method of the present invention.

[0007] Figure 3 is a block diagram showing one embodiment of a system in accordance with the present invention.

[0008] Figure 4 is a flowchart showing another embodiment of a system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] The present invention provides a method for automatically linking a physical device with a predetermined associated virtual device to obtain services. The method includes the steps of: manufacturing the physical device that is associated with the predetermined virtual device and attaching to the physical device a substantially unremovable communication identifier for communicating with the predetermined virtual device. Typically, the physical device and the predetermined virtual device communicate over an information space such as the Internet.

[00010] In another embodiment, the method for automatically providing electronic services for a physical device having a substantially non-removable communication identifier is implemented by manufacturing the physical device with a substantially non-removable communication identifier, followed by utilizing, by a user, the communication identifier to communicate with a predetermined associated avatar to request at least one service.

[00011] The invention also provides a system for automatically linking a physical device with a predetermined associated virtual device. The physical device has a substantially unremovable communication identifier in a readily accessible position so that the communication identifier may be used to facilitate communication with the predetermined associated virtual device. When the communication identifier is used to facilitate the communication between the physical device and the predetermined associate virtual device, the physical device may receive at least one predetermined service via the predetermined associated virtual device.

[00012] In another embodiment, the invention provides a system for automatically providing electronic services for a physical device that has a substantially non-removable communication identifier located in a readily accessible position of the physical device. The communication identifier is used to facilitate communication of the physical device with a predetermined associated avatar to request at least one service. When the request is received, the at least one service may be activated, or alternatively, if a plurality of services are shown to be available, a user may select the desired services for the physical device.

[00013] The present invention provides for local discovery of services associated with a particular physical device that remains valid independent of the current physical location of the physical device. In this manner, a purchaser of a physical device that has an associated virtual device may readily configure the physical device with services obtained via the associated virtual device.

[00014] Frequently, shared network printers may have a label taped on them to indicate their network identity so that users can readily identify the printers

on a network listing. However, such labels may not be permanently valid. For example, such a label may be invalidated by moving the printer from one physical location to another physical location. Also, when a printer is moved from one location to another, the printer may require a network administrator to set up the printer for the new location.

[00015] Sometimes, personal computers have labels affixed to them. Such labels may sometimes remain valid for a variety of locations, but the labels need to be configured to validate the label. A device that needs to be configured may be subject to losing the configuration, thus requiring reconfiguration. In some embodiments, dynamic labels may be provided in the form of beacons or the like, but such a method increases the cost associated with maintaining the device and the complexity of local administration of such maintenance.

[00016] Physical devices may be, for example, devices such as a personal digital assistant, a personal computer, a printer, a scanner, a mobile phone, or devices that less frequently are connected to networks, such as clocks, (desk) telephones, home appliances, kitchen appliances, and the like. A Uniform Resource Identifier (URI, sometimes also known as a URL) is a string, generally short, that identifies a resource or resources in the web such as documents, images, downloadable files, services, electronic mailboxes, and the like. The resources may be made available under a variety of naming schemes and access methods such as HyperText Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet mail addresses, and the like. A "device avatar URI" is defined as a universal resource indicator that may be used to provide a communication path for a physical device that is associated with a selected virtual device (also known as an avatar) via a publicly visible, permanently affixed, human and/or machine readable label. Typically, such a label may be affixed to the physical device during manufacture of the device.

[00017] The present invention provides a method and system that combine the service location permanence of a device avatar with the a human and/or machine readable label that is affixed to the device, typically at the time of

manufacture. The combination provided by the invention is location independent, universally understandable, and does not require configuration or local maintenance.

[00018] As technology progresses, technical solutions are needed to facilitate the new combinations of physical devices and virtual devices that provide services. Such virtual devices that are associated with particular physical devices to provide services to the physical devices are called device avatars. The present invention facilitates communication between the physical devices and their associated virtual counterparts, the device avatars. By affixing a communication identifier to the physical device that allows the physical device to locate, in information space, the device avatar that is associated with the physical device, each physical device is correlated with its associated virtual device without undue difficulty.

[00019] A user does not need to seek out a written document, which may have become misplaced or lost, in order to seek or update the services available to the physical device. Though the physical device may have an address that is neither fixed not outwardly identifiable, the present invention provides for affixing the associated avatar's URI to the physical device in a substantially non-removable form so that the physical device may use the URI to communicate with the associated device avatar to obtain services. In one embodiment, the URI may be molded into the case or outer covering of the device. However, the URI may also be painted onto the device, be located on a riveted nameplate, or the like.

[00020] As shown in FIG. 1, the present invention provides a method for automatically linking a physical device and a predetermined associated virtual device to facilitate obtaining services for the physical device. The method includes the steps of manufacturing 102 the physical device that is associated with the predetermined virtual device and attaching 104, to the physical device, a substantially unremovable communication identifier for communicating with the predetermined virtual device. Typically, the physical device communicates with the predetermined virtual device over an information space such as the Internet. Upon the physical device's

communicating with the predetermined virtual device, the predetermined virtual device may provide at least one predetermined service 106, or alternatively, a selection of services 108. Generally, where a selection of services is provided, a user may select 110 as many services as are desired.

[00021] Some physical devices may not be configured to permit ready selection of services. In such a case, an intermediate device may be utilized 112 to allow the physical device to communicate with the predetermined virtual device. For example, a console or computer may be coupled to the physical device and may be used to enter the communication identifier, such as a URI, that is provided on the physical device. The console or computer then communicates with the associated virtual device, determines what service or services are available, and communicates the service or services to the physical device. Clearly, couplings may be wireless or wired.

[00022] Any suitable naming scheme may be utilized for the communication identifier. For example, a HyperText Transfer Protocol naming scheme, a File Transfer Protocol naming scheme, or an Internet mail address naming scheme may be used.

[00023] FIG. 2 illustrates another embodiment of the present invention wherein the method for automatically providing electronic services for a physical device having a substantially non-removable communication identifier includes the steps of manufacturing 202 the physical device with a substantially non-removable communication identifier and utilizing 204, by a user, the communication identifier to communicate with a predetermined associated avatar to request at least one service. The predetermined associated avatar may generally be a virtual unit that has been programmed to identify the physical device and to provide at least one service to the physical device.

[00024] In one embodiment, the predetermined associated avatar may automatically activate 206 at least one predetermined service. Also, upon utilizing the communication identifier to communicate with the predetermined associated avatar, the predetermined associated avatar may provide 208 a

selection of services from a predetermined list of services. The user typically may select 210 at least one desired service. For example, where the physical device is a cellular telephone, the virtual unit may be arranged to allow the user to select printing out his email messages on a particular printer.

[00025] In a preferred embodiment, the physical device may utilize 212 the communication identifier to communicate with the predetermined associated avatar via the Internet. Again, where desired, an intermediate device may be utilized 214 to couple the physical device to the predetermined associated avatar. Typical intermediate devices are consoles and computers.

[00026] The communication identifier is generally a Uniform Resource Identifier (URI). URIs provide a simple and extensible way to identify a resource. URIs are characterized using the descriptions set forth below.

[00027] "Uniform" allows different types of resource identifiers to be used in the same context, even when the mechanisms used to access those resources may be different. Uniform semantic interpretation of common syntactic conventions may be employed across different types of resource identifiers. New types of resource identifiers may be introduced without interfering with the way that existing identifiers are used. Also, identifiers may be reused in many different contexts so that new applications or protocols may leverage pre-existing, large and widely-used sets of resource identifiers.

[00028] A "Resource" is anything that has an identity. Typical resources include electronic documents, images, service (such as reports) and the like. Some resources, such as humans, corporations, and textbooks are not network "retrievable", but are still considered resources. A resource typically is a conceptual mapping to an entity or set of entities, not necessarily the entity that corresponds to that mapping at any particular instance in time. Hence, a resource can remain constant even when its content, i.e., the entities to which it currently corresponds, changes over time, but only if the conceptual mapping is not changed in the process.

[00029] An "Identifier" is an object that can act as a reference to something that has identity. Thus, for a URI, the object is a sequence of characters with a restricted syntax.

[00030] A URI may be further described as a locator, a name or both. The term "Uniform Resource Locator" (URL) refers to a subset of URIs that identify resources using a representation of their primary access mechanism or "location" in the network. A "Uniform Resource Name" (URN) is the subset of URIs that are required to remain globally unique and persistent even if the resource ceases to exist or becomes unavailable.

[00031] A URI may further restrict the syntax and semantics of identifiers for the namespace using the selected scheme. Any workable naming scheme, such as, for example, HyperText Transfer Protocol, File Transfer Protocol, an Internet mail address or the like, may be used for the communication identifier. However, although many resource identifier schemes are named after protocols, this does not imply that the only way to access the URI's resource is via the named protocol.

[00032] As shown in FIG. 3, the present invention may be implemented by a system that provides automatic linking of a physical device 302 and a predetermined associated virtual device 304. Generally, the system includes the physical device, which has a substantially unremovable communication identifier 306 in a readily accessible position of the physical device so that a user can either read it or use a machine to read it, and the predetermined associated virtual device. The communication identifier, such as a URI, may be used to communicate with the predetermined associated virtual device. The physical device is arranged to be capable of receiving at least one predetermined service, and the predetermined virtual device is arranged to be accessible by the physical device using the communication identifier and to, upon being accessed by the physical device, provide at least one predetermined service. Communication is generally achieved over an information space such as the Internet.

[00033] Alternatively, the system may be arranged to have the predetermined virtual device provide a selection of predetermined services so that the user may select, if desired, more than one service.

[00034] The system may further include an intermediate device 308, such as, for example, a console or a computer, that is arranged to facilitate communication between the physical device and the predetermined virtual device. The intermediate device 308 may be arranged to utilize wireless or wired communication with the physical device 302 and/or the predetermined associated virtual device 304, as desired. The communication identifier may typically be a Uniform Resource Identifier with a desired naming scheme such as, for example, a HyperText Transfer Protocol naming scheme, a File Transfer Protocol naming scheme, or an Internet mail address naming scheme.

[00035] The predetermined associated virtual device 304 may, for example, be a server, a database, or the like, that provides for storing, and generally facilitating retrieval of, information associated with the physical device 302 and its predetermined associated virtual device 304.

[00036] FIG. 4 shows another embodiment of a system for automatically providing electronic services for a physical device 402 having a substantially non-removable communication identifier 404. The physical device 402 has a substantially non-removable communication identifier 404. The communication identifier 404 is generally located in a readily accessible position of the physical device 402 and may be used for facilitating communication of the physical device 402 with a predetermined associated avatar to request at least one service. A user utilizes the communication identifier 404 to send a request to the predetermined associated avatar 406, which then activates the at least one predetermined service. For example, a URI may be molded into the case of the physical device 402. Where the physical device 402 is, for example, a personal digital assistant (PDA), the user inputs the URI into the PDA, which then connects the PDA to the predetermined associated avatar 406. When the user purchased the PDA, he may have obtained the capability of a service such as directing, using the

services at the predetermined associated avatar 406, printing of information from the PDA to a selected printer. Alternatively, he may be able to access and/or activate a selection of a plurality of services via the associated avatar 406 or may be able to select and activate additional services to a service or services that he already purchased. In one embodiment, the user may use the communication identifier 404 to communicate with the predetermined associated avatar 406 via the Internet.

[00037] Where, for example, the physical device 402 may not be configured to connect directly to the predetermined associated avatar 406, an intermediate device 408 such as, for example, a console or computer, may be arranged to communicate with the physical device 402 and use the communication identifier 404 to communicate with the predetermined associated avatar 406. For example, where the physical device 402 is a printer, the printer may not have the capability of communicating directly with its predetermined associated avatar 406. Here, the printer may be arranged to communicate with an intermediate device 408, such as a console or a computer, that then uses the communication identifier 404 to communicate with the predetermined associated avatar 406. Again, desired services may be selected and activated using the predetermined associated avatar 406.

[00038] The predetermined associated avatar 406 may, for example, be a server, a database, or the like, that provides for storing, and generally facilitating retrieval of, information associated with the physical device 402 and its predetermined associated avatar 406.

[00039] As in the above embodiment, the communication identifier may typically be a Uniform Resource Identifier with a desired naming scheme such as, for example, a HyperText Transfer Protocol naming scheme, a File Transfer Protocol naming scheme, or an Internet mail address naming scheme.

[00040] Thus, a method and system have been described for facilitating service delivery between a physical device and an associated virtual device according to the present invention. Many modifications and variations may be made to the techniques and structures described and illustrated herein without departing from the spirit and scope of the invention. Accordingly, it

should be understood that the method and system described herein are illustrative only and are not limiting upon the scope of the invention.

CLAIMS

What is claimed is:

1. A system 302, 304 for providing for automatic linking of a physical device and a predetermined associated virtual device, comprising:

the physical device 302, having a substantially non-removable communication identifier 306 in a readily accessible position of the physical device 302, wherein the communication identifier 306 facilitates communication with the predetermined associated virtual device 304, and the physical device 302 is arranged to be capable of receiving at least one predetermined service; and

the predetermined virtual device 304, arranged to be accessible by the physical device 302 using the communication identifier 306, for, upon being accessed by the physical device 302, providing at least one predetermined service.

2. The system of claim 1 wherein the physical device 302 communicates with the predetermined virtual device 304 over an information space.

3. The system of claim 2 wherein the information space is the Internet.

4. A system 402, 404, 406 for automatically providing electronic services for a physical device, comprising:

the physical device 402, having a substantially non-removable communication identifier; and

the communication identifier 404, located in a readily accessible position of the physical device 402, for facilitating communication of the physical device 402 with a predetermined associated avatar 406 to request at least one service.

5. The system of claim 4 wherein the predetermined associated avatar 406, upon receiving the request, activates the at least one service.

6. The system of claim 4 wherein the predetermined associated avatar 406, upon receiving the request, provides a selection of predetermined services.

7. The system of claim 4 wherein the physical device 402 utilizes the communication identifier 404 to communicate with the predetermined associated avatar via the Internet.

8. The system of claim 4 further including an intermediate device 408 that is arranged to be utilized by the physical device 402 to access the predetermined associated avatar 406, wherein the intermediate device 408 is utilized to couple the physical device 402 to the predetermined associated avatar 406.

9. A method 202, 204 for automatically providing electronic services for a physical device having a substantially non-removable communication identifier, comprising the steps of:

manufacturing 202 the physical device with a substantially non-removable communication identifier; and

utilizing 204, by a user, the communication identifier to communicate with a predetermined associated avatar to request at least one service.

10. The method of claim 9 further including automatically activating 206, by the predetermined associated avatar, at least one predetermined service.

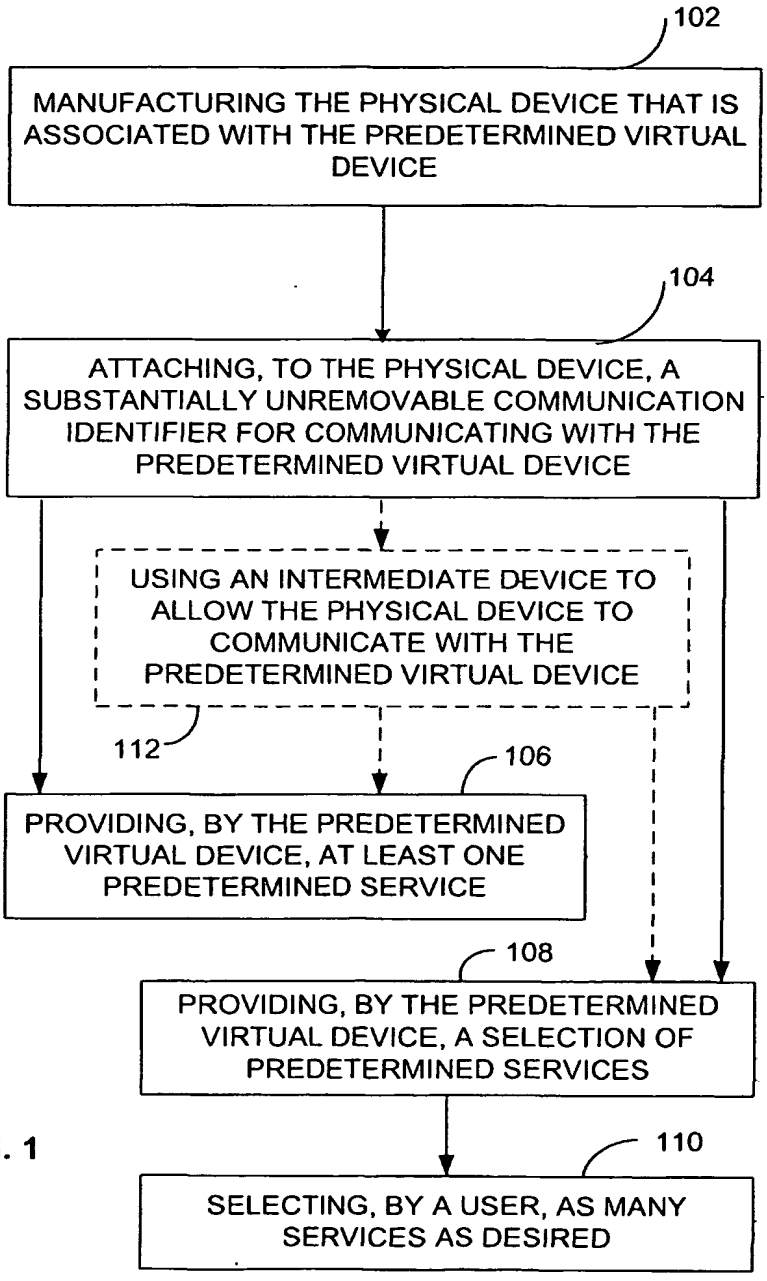
102
MANUFACTURING THE PHYSICAL DEVICE THAT IS ASSOCIATED WITH THE PREDETERMINED VIRTUAL DEVICE
104
ATTACHING, TO THE PHYSICAL DEVICE, A SUBSTANTIALLY UNREMOVABLE COMMUNICATION IDENTIFIER FOR COMMUNICATING WITH THE PREDETERMINED VIRTUAL DEVICE
USING AN INTERMEDIATE DEVICE TO ALLOW THE PHYSICAL DEVICE TO COMMUNICATE WITH THE PREDETERMINED VIRTUAL DEVICE
112
106
PROVIDING, BY THE PREDETERMINED VIRTUAL DEVICE, AT LEAST ONE PREDETERMINED SERVICE
108
PROVIDING, BY THE PREDETERMINED VIRTUAL DEVICE, A SELECTION OF PREDETERMINED SERVICES
110
SELECTING, BY A USER, AS MANY SERVICES AS DESIRED

FIG. 1

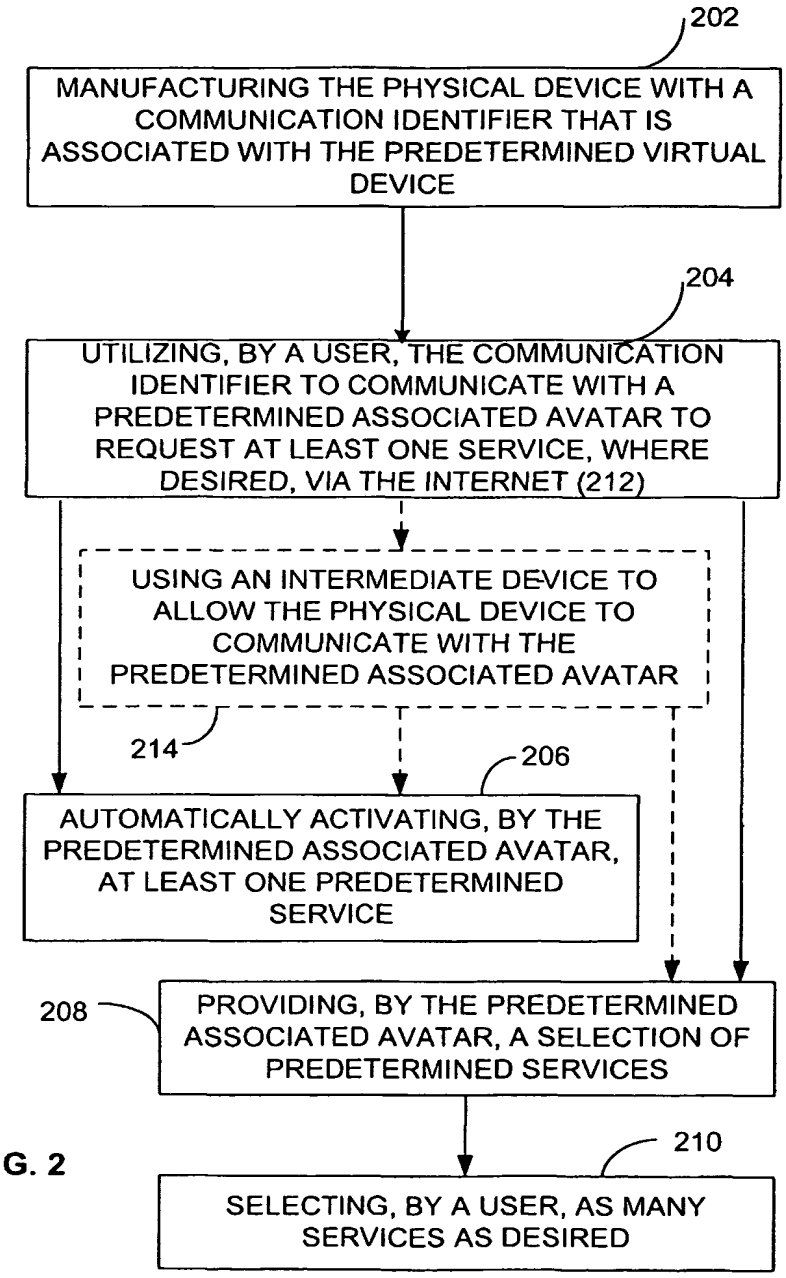
202
MANUFACTURING THE PHYSICAL DEVICE WITH A COMMUNICATION IDENTIFIER THAT IS ASSOCIATED WITH THE PREDETERMINED VIRTUAL DEVICE
204
UTILIZING, BY A USER, THE COMMUNICATION IDENTIFIER TO COMMUNICATE WITH A PREDETERMINED ASSOCIATED AVATAR TO REQUEST AT LEAST ONE SERVICE, WHERE DESIRED, VIA THE INTERNET (212)
USING AN INTERMEDIATE DEVICE TO ALLOW THE PHYSICAL DEVICE TO COMMUNICATE WITH THE PREDETERMINED ASSOCIATED AVATAR
214
206
AUTOMATICALLY ACTIVATING, BY THE PREDETERMINED ASSOCIATED AVATAR, AT LEAST ONE PREDETERMINED SERVICE
208
PROVIDING, BY THE PREDETERMINED ASSOCIATED AVATAR, A SELECTION OF PREDETERMINED SERVICES
210
SELECTING, BY A USER, AS MANY SERVICES AS DESIRED

FIG. 2

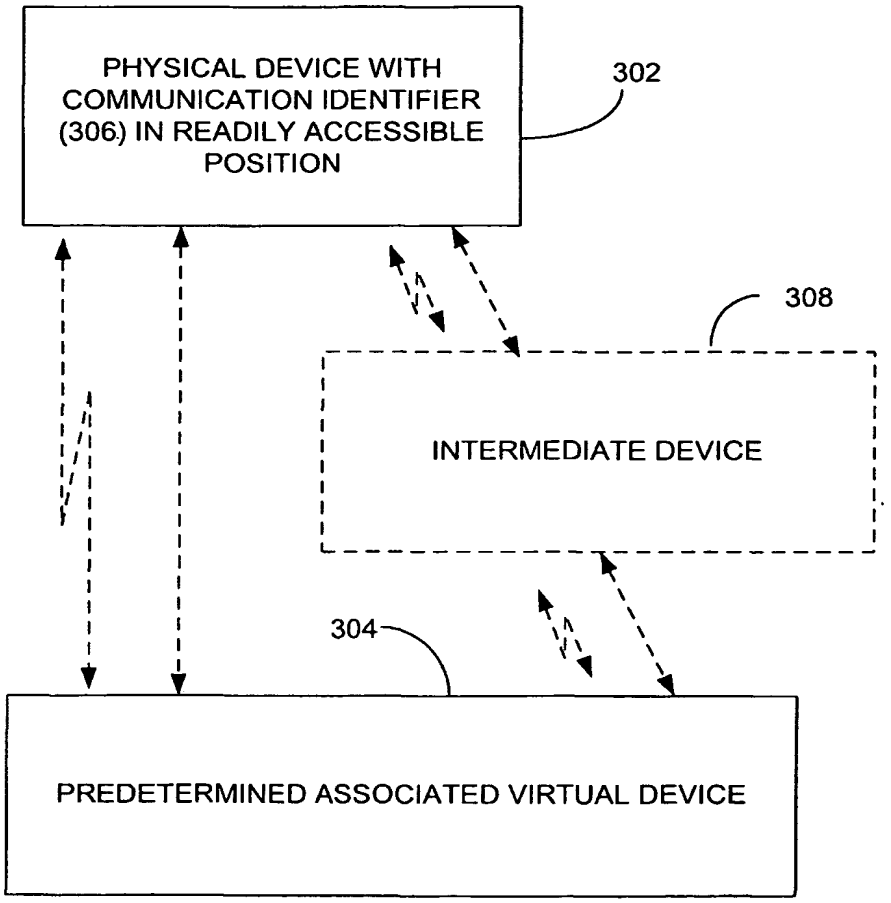
PHYSICAL DEVICE WITH COMMUNICATION IDENTIFIER (306) IN READILY ACCESSIBLE POSITION
302
308
INTERMEDIATE DEVICE
304
PREDETERMINED ASSOCIATED VIRTUAL DEVICE

FIG. 3

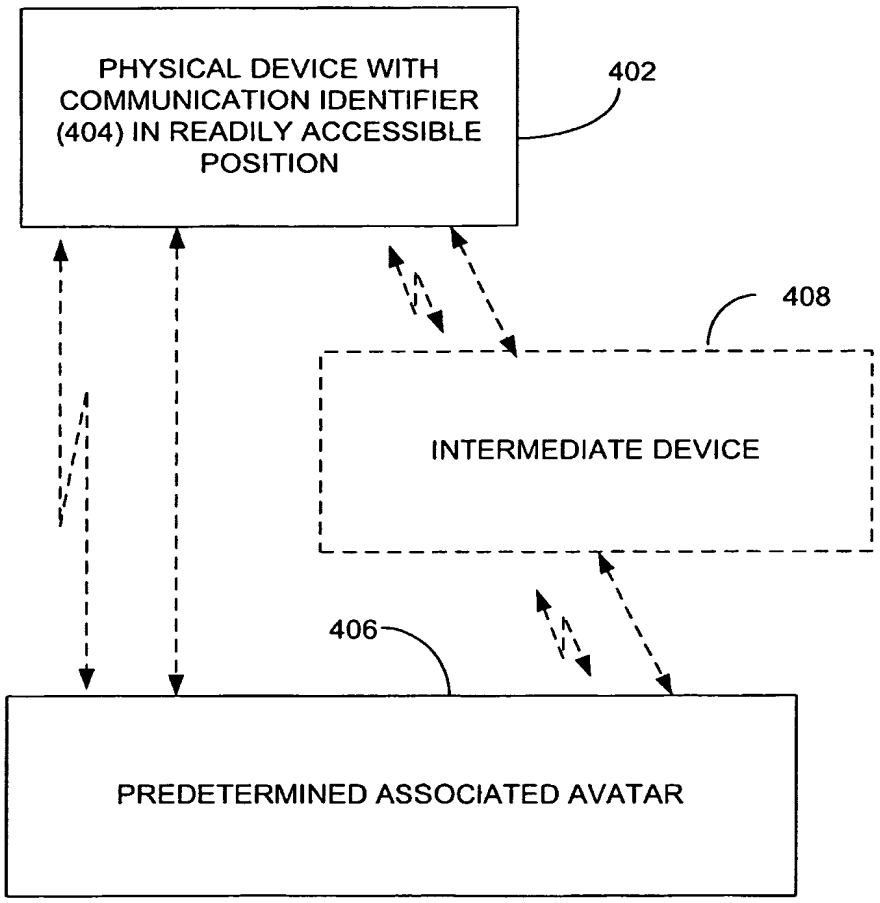
PHYSICAL DEVICE WITH COMMUNICATION IDENTIFIER (404) IN READILY ACCESSIBLE POSITION
402
408
INTERMEDIATE DEVICE
406
PREDETERMINED ASSOCIATED AVATAR

FIG. 4

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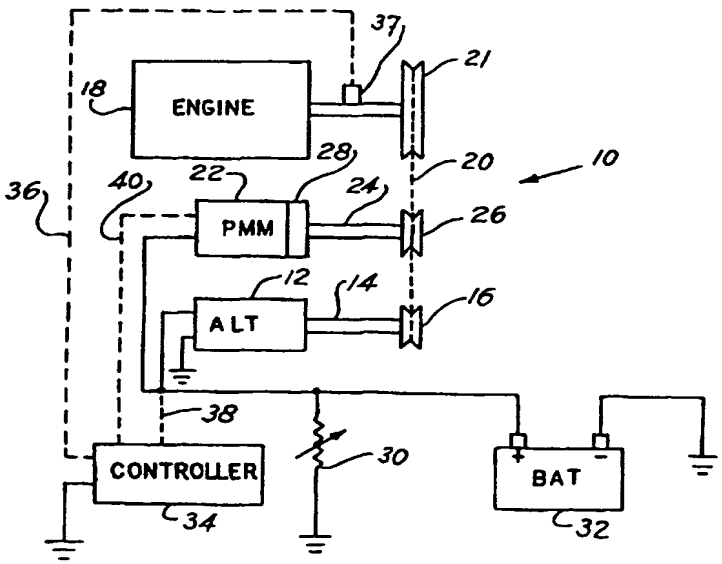
(54) Title: MOTOR VEHICLE ELECTRICAL SUPPLY SYSTEM AND METHOD



(57) Abstract

A hybrid alternator system (10) provides supplemental electrical energy to a motor vehicle at low engine speeds. A permanent magnet motor (22) is adapted to be driven by the vehicle engine (18) and is coupled into the vehicle electrical system for supplementing the electrical output of the primary alternator (12).

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MOTOR VEHICLE ELECTRICAL SUPPLY SYSTEM AND METHOD

Field of the Invention

The present invention relates generally to automotive electrical systems, and more particularly, to a hybrid electrical generation system for providing electrical energy to the automobile electrical system.

Background of the Invention

Modern automobiles are equipped with a myriad of electrical equipment. Most automobiles include windshield wiper systems, electrical window defogger systems, heater, ventilation and air conditioning (HVAC) systems, interior and exterior lighting systems, in addition to engine and transmission electrical control systems. Moreover, many modern luxury automobiles include power adjustable and heated seating systems, power mirror and window systems, automatic adjusting suspension systems, and more. Automobile electrical systems are designed to include a lead-acid type electric storage battery which operates in conjunction with the alternator system.

During operation of the automobile, electrical energy is provided by the alternator system, which is driven by the internal combustion engine, to the electrical systems and to charge the battery. For example, the electrical output of a typical 100 Ampere (Amp) alternator is shown in Figure 3. At engine speeds above approximately 2500 revolutions-per-minute (RPM) the alternator produces the rated 100 Amps of electrical energy at approximately 14.4 volts. However, below 2500 RPM, the output of the alternator drops off dramatically, and at a typical engine idle speed of about 800 RPM, the alternator provides only about 35 Amps.

To provide supplemental electrical power when the alternator cannot meet the electrical demands of the vehicle electrical system, power is provided from the battery causing it to discharge. As can be appreciated, the battery discharges during low alternator output and recharges during rated alternator output. This discharge/recharge cycling of the battery, however, greatly reduces the useful life of the battery particularly when coupled with the ever increasing underhood temperatures of modern automobiles. The condition is further exacerbated in high ambient temperature regions such as found in the southwestern United States.

It is possible, by providing larger capacity alternators, to increase the electrical output at lower engine speeds. However, such efforts meet the practical limitations of overly increasing the physical size and weight of the alternator when there is little available room in the engine compartment for the device and adversely increasing the initial as well as replacement cost of the device. Others have increased alternator output by increasing engine idle speed when a sensed battery voltage drops below a preset threshold. This method suffers the disadvantages of increasing vehicle emissions and reducing fuel economy at idle. Yet another approach provides first and second stage windings within an alternator to provide enhanced output at lower engine speeds. Again, this solution suffers the disadvantage of increasing physical size and weight of the alternator as well as initial and replacement cost.

As a result, the problem of discharge/recharge cycling of the battery due to low alternator output at low engine speeds persists.

Summary of the Invention

The present invention provides a hybrid alternator system having a supplemental source of electrical energy at lower engine speeds. The system includes a permanent magnet direct current (DC) motor adapted to be driven by the vehicle internal combustion engine. In a preferred embodiment of the present invention, the permanent magnet motor is mounted to the engine with its rotor shaft perpendicular to the plane of the accessory drive belt system. A pulley engages the accessory drive belt and provides driving torque to the rotor shaft for turning the rotor. The motor is electrically coupled into the vehicle electrical system for providing supplemental electrical energy to that provided by the alternator.

Another aspect of the present invention provides a control system for a hybrid alternator system including an alternator and a supplemental permanent magnet motor each adapted to be driven by the internal combustion engine. The permanent magnet motor is adapted with a clutch for selectively coupling drive torque from the internal combustion engine to the permanent magnet motor. A controller is provided and monitors the engine speed and battery parameters for providing a control signal to the clutch.

By providing a source of supplemental electrical energy smaller, lighter and less expensive primary alternators may be employed within the vehicle design.

Moreover, by maintaining the battery at a higher state of charge and reducing discharge/recharge cycling, battery life may be substantially increased.

In another aspect of the present invention, the battery is eliminated from a vehicle equipped with the hybrid alternator system of the present invention. A charged capacitor is provided for providing electrical energy for starting the vehicle while the hybrid alternator system provides sufficient electrical energy to the vehicle over all engine speeds.

These and other advantages and features of the present invention will be ascertained from the following detailed description of a preferred embodiment and the accompanying drawings.

Brief Description of the Drawings

FIG. 1 generally illustrates an alternator system in accordance with a preferred embodiment of the present invention;

FIG. 2 is a flow chart illustrating a preferred control strategy associated with the alternator system; and

FIG. 3 illustrates electrical output of an alternator system in accordance with a preferred embodiment of the present invention.

Detailed Description of a Preferred Embodiment

With reference to Fig. 1, a hybrid alternator system 10 in accordance with a preferred embodiment of the present invention includes a primary energy generation device 12, in the preferred embodiment a typical motor vehicle alternator, having an input shaft 14 and a drive pulley 16 is adapted to receive driving torque from internal combustion engine 18 via drive belt 20. Similarly a secondary energy generation device 22, in a preferred embodiment a DC permanent magnet motor, having an input shaft 24 and a drive pulley 26 is adapted to receive driving torque from internal combustion engine 18 via drive belt 20 and engine pulley 21. Permanent magnet motor 22 may be a Geared Cobol 40 by Astro, Inc. and is adapted with an electrically actuatable clutch mechanism 28 such as a model CFC flange mounted clutch available from American Precision Industries selectively coupling and decoupling driving torque from engine 18 to motor 22.

Alternator 12 is typical and includes suitable voltage regulator circuitry (not shown), either internal or external to alternator 12, for regulating the voltage and

current output of alternator 12 under normal operating conditions as is well known in the art. Electrical output of alternator 12 is coupled to the electrical load of the vehicle, schematically indicated as 30, and to electric storage battery 32. Under normal operating conditions, with internal combustion engine 19 operating in excess of approximately 1500 RPM, alternator 12 produces sufficient electrical energy to satisfy vehicle electrical load 30 as well as to provide electrical energy for charging battery 32. However, and as previously discussed, at engine speeds less than 1500 RPM the electrical output of alternator 12 drops off rapidly such that alternator 12 may produce an insufficient supply of electrical energy to satisfy vehicle load 30.

In accordance with the present invention and with reference to Fig. 2, controller 34 senses two operating variables: engine RPM (step 200) and battery voltage (step 204). A RPM sensor 31, preferably the existing RPM sensor providing RPM information to the engine controller, provides a signal indicative of engine RPM to controller 34 via signal line 36. Similarly, controller 34 senses battery voltage via signal line 38. If the engine RPM is below a threshold value, for example approximately 1500 RPM, (step 202), controller 34 checks if the battery voltage is below a preset threshold (step 206). If the battery voltage is below the threshold, for example approximately 13.1 volts, this is an indication that alternator 12 is not providing sufficient electrical energy to vehicle electrical load 30 and that battery 32 is in a state of discharge. In response, controller 34 sends a signal to clutch mechanism 28 via signal line 40 engaging clutch mechanism 28 (step 208) for transferring driving torque from engine 18 to motor 22. Otherwise, controller 34 provides a signal on signal line 40 disengaging clutch mechanism 28 (step 210) such that torque is not delivered to motor 22. it should be understood that a certain amount of hysteresis is such that the disengage signal is not sent until the battery voltage is above a threshold, for example 14.0 volts, and the engine RPM is above a threshold, for example 1750 RPM.

When driven, motor 22 produces an electrical output. An electrical output characteristic of a preferred motor 22 is illustrated in Fig. 3 as curve "M". This electrical energy, when summed with the then current output of alternator 12, produces the hybrid system electrical output illustrated in Fig. 3 as curve "HII. Hence, it can be seen from Fig. 3 that the electrical output is greatly enhanced at low engine RPM. The additional electrical energy being made available to load 30 thereby reducing discharge/recharge cycling of battery 32.

As will be appreciated, motor 22 is intended only to be driven at low engine RPM and hence is adapted for proportional rotation with engine 18 such that optimum electrical output occurs between about 500 and 1500 engine RPM. However, it is not desirable to drive motor 22 at higher engine RPM as this places unnecessary stress on motor 22 since alternator 12 is capable of providing sufficient electrical energy above 1500 engine RPM. Similarly, if battery voltage is not below the threshold at low engine RPM, i.e. vehicle load 30 is low, there is no requirement to provide supplemental electrical energy and clutch 28 remains disengaged.

Motor 12 is small and lightweight as compared to known larger capacity alternators. In addition, separating the primary and secondary electrical generation sources provide enhanced adaptability and allows for easier and more cost effective service.

The present invention has been described in terms of a preferred embodiment for a hybrid energy system having an alternator and a permanent magnet motor. one will appreciate that the permanent magnet motor may be replaced with a secondary, lower capacity alternator without departing from the scope of the present invention. In addition, because the present invention provides an electrical system capable of providing sufficient electrical energy at low engine RPM, there is no longer a need for battery 32 to provide supplemental electrical energy. Hence, battery 32 may be made smaller or eliminated altogether by providing an alternate source of starting energy to engine 18 such as a capacitance electrical energy source or in-cylinder charge ignition.

In view of the foregoing discussion of a preferred embodiment, one of ordinary skill in the art will readily appreciate the broad scope of the present invention set forth in the subjoined claims.

CLAIMS

1. A system for providing electrical energy in a motor vehicle having an internal combustion engine, comprising:

a primary energy generation device drivingly coupled for proportional rotation to the internal combustion engine for supplying electrical power to vehicle electrical loads;

a secondary energy generation device selectively coupled in response to a speed of the internal combustion engine for proportional rotation to the internal combustion engine for providing supplemental electrical power to the vehicle electrical loads.

2. The system of claim 1 wherein the secondary energy generation device comprises a permanent magnet motor.

3. The system of claim 1 wherein the secondary energy generation device includes a electrically actuatable clutch for selectively coupling and decoupling driving torque from the internal combustion engine.

4. The system of claim 3 further comprising a controller adapted to receive a signal indicative of the speed of the internal combustion engine, the controller operable for generating a control signal and wherein the eclectically actuatable clutch is responsive to the control signal for selectively coupling and decoupling driving torque from the internal combustion engine.

5. The system of claim 1 wherein the motor vehicle further comprises an electric storage battery, and wherein the secondary energy generation device is further selectively coupled in response to a battery parameter for proportional rotation to the internal combustion engine for providing supplemental electrical power to the vehicle electrical loads.

6. The system of claim 5 wherein the battery parameter comprises battery voltage.

7. The system of claim 5 wherein the primary and secondary energy generation devices provide electrical energy for charging the electric storage battery.

8. A method of providing electrical energy to a motor vehicle electrical system, the motor vehicle electrical system having a battery, the motor vehicle having an internal combustion engine and a first and a second source electrical energy adapted to be driven from the internal combustion engine, and the method comprising the steps of:

engaging the first source of electrical energy at all engine speeds;

sensing engine speed;

engaging the second source of electrical energy when the engine speed is below an engine speed threshold.

9. The method of claim 8 further comprising the step of sensing at least one battery parameter; and the step of engaging the second source of electrical energy comprises engaging the second source of electrical energy when the battery parameter is below a battery parameter threshold.

10. The method of claim 9 wherein the step of sensing at the least one battery parameter comprises sensing battery voltage.

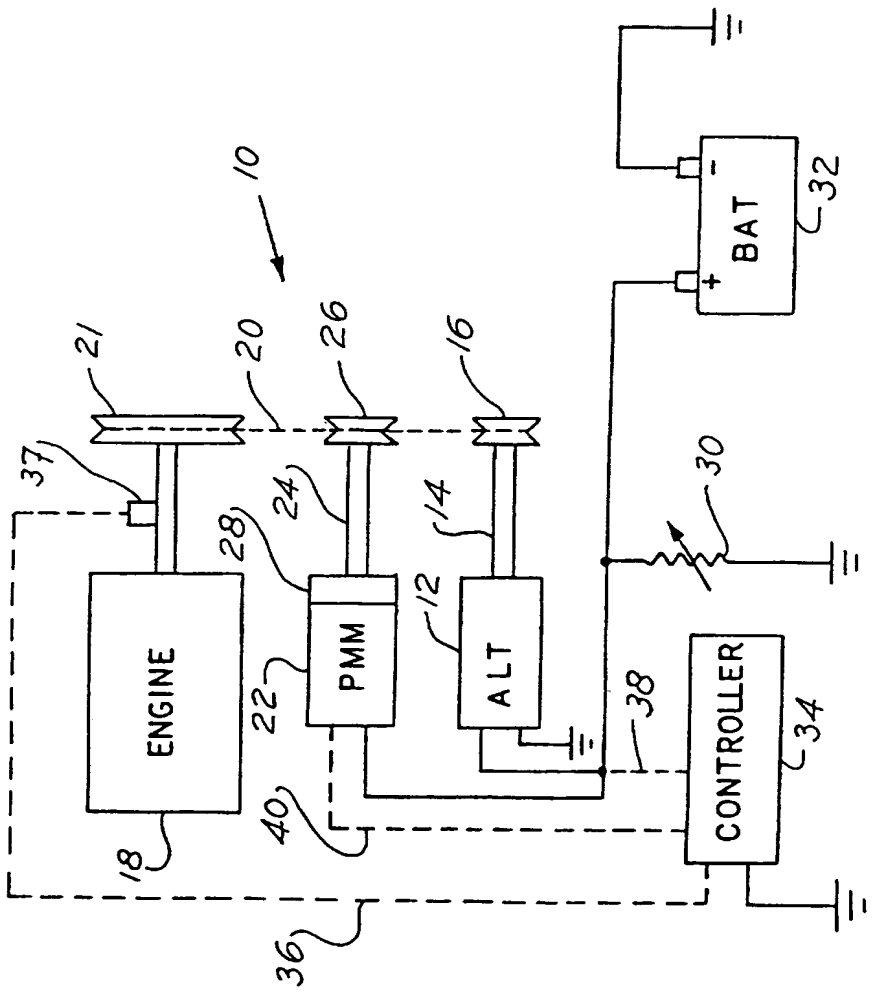
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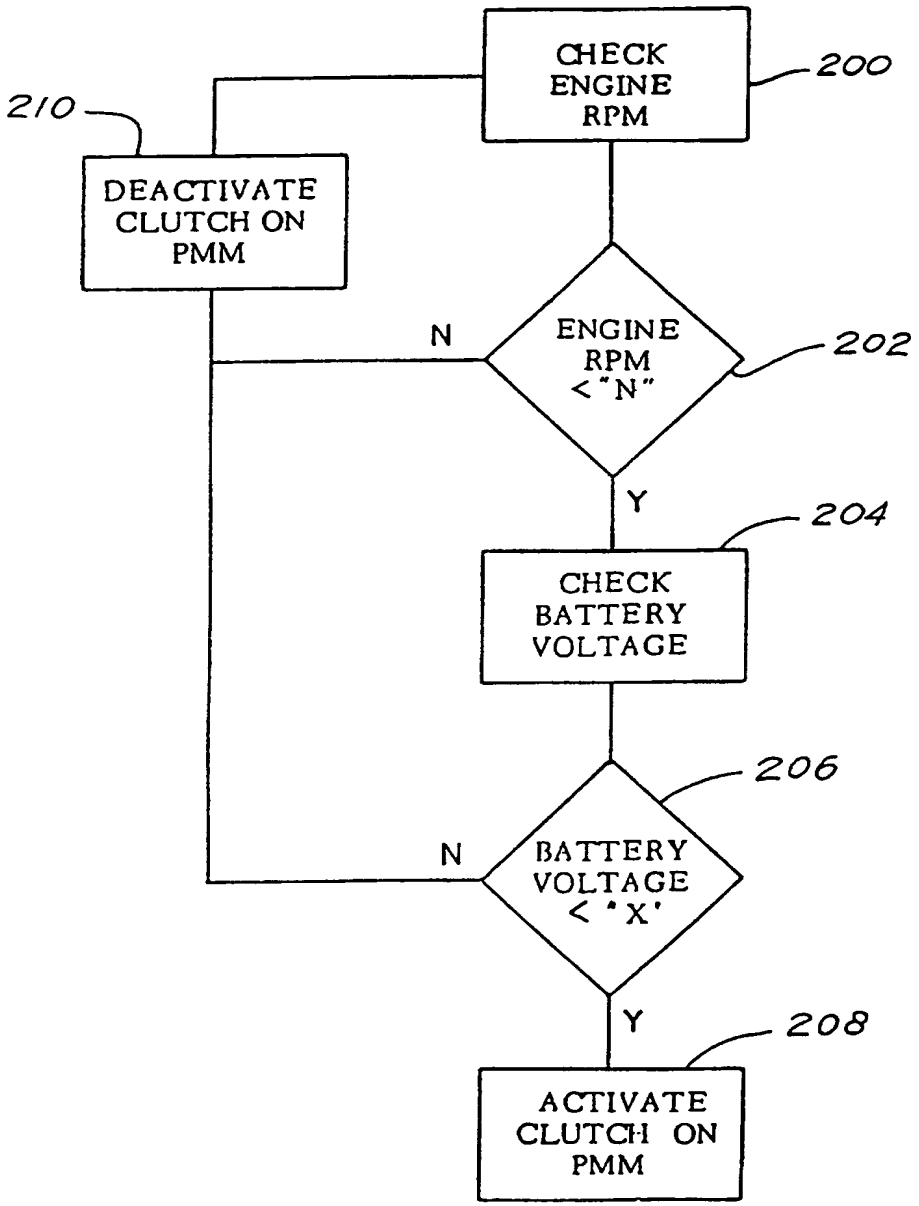
FIG. 1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210
DEACTIVATE CLUTCH ON PMM
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204
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BATTERY VOLTAGE < 'X'
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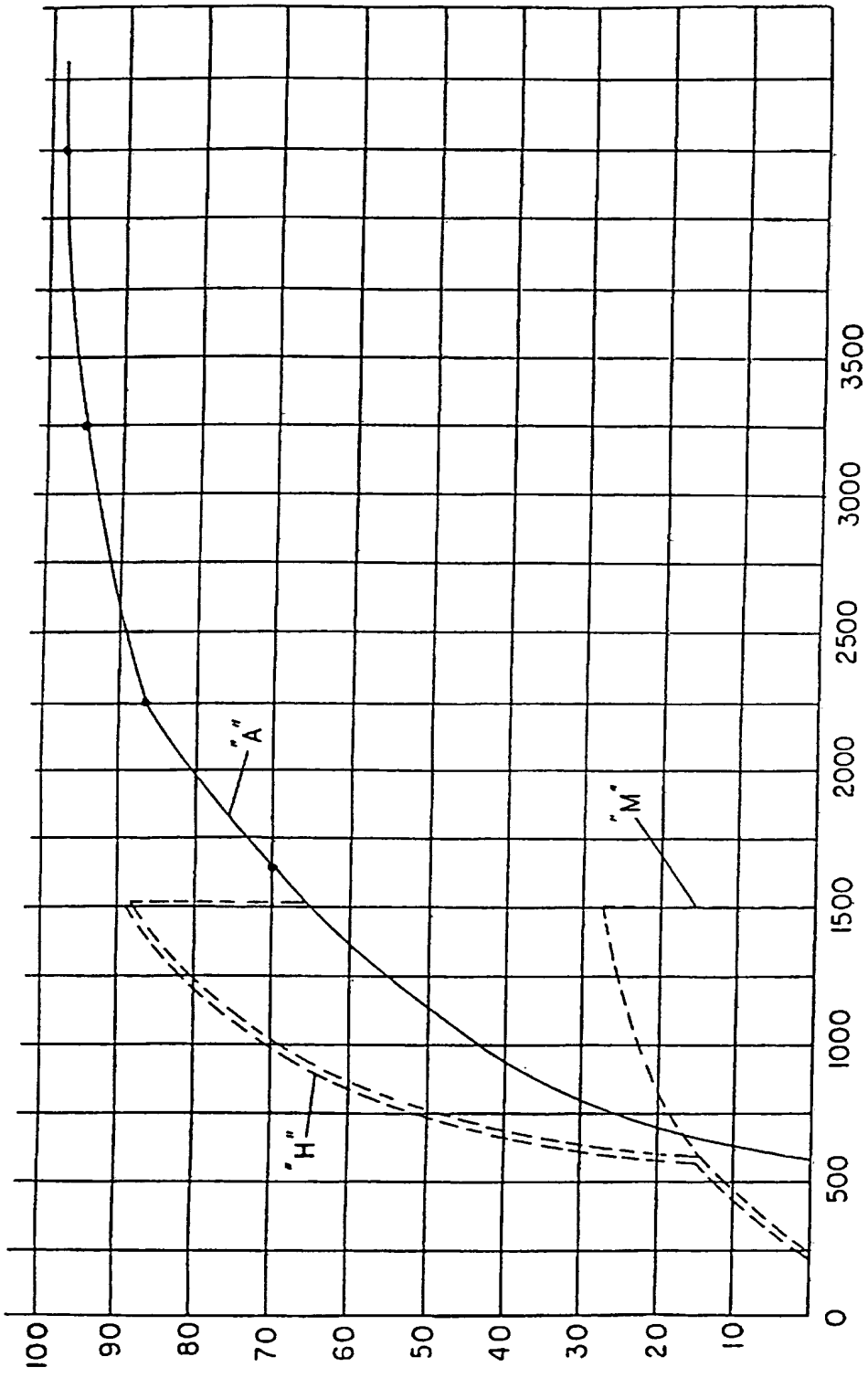
208
ACTIVATE CLUTCH ON PMM

FIG. 2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70
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"A"
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"H"

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/19121

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B60K 1/02
US CL :180/65.3; 322/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 180/65.2, 65.3, 65.4; 322/16, 22; 320/64

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,350,031 (SUGIYAMA ET AL) 27 September 1994 see Figure 1	1-10
Y	US 3,315,148 (GRILLO) 18 April 1967 see Figures 1 & 2, generators 16 & 48 driven by drive means 12	1-10
A	US 2,434,413 (JUSTUS) 13 January 1948	
A	US 4,604,565 (YOKOTA ET AL) 05 August 1986	
A	US 3,517,766 (WEST) 30 June 1970	
A	US 4,095,664 (BRAY) 20 June 1978	

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 10 FEBRUARY 1997	Date of mailing of the international search report 25 FEB 1997
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